

SECTION 11

HULL PIPING SYSTEMS

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11.1 REFERENCE	
(11A) Code of Federal Regulations – 46 CFR Sub-chapter F	
(11B) Code of Federal Regulations – 46 CFR Sub-chapter H	
(11C) Code of Federal Regulations – 33 CFR Sub-chapter O	

11.2 INTRODUCTION

This Section contains the Contractor Design and Provide general requirements for the various hull piping systems on the Vessel. Dewatering, vents, sounding tubes, overflow piping, sanitary drains, interior deck drains, weather deck drains, and sea chest piping are provided in this Section of the Technical Specification.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

11.3 GENERAL

BE ADVISED: The Contractor is reminded and advised that sanitary drain/discharge installations, such as sewage removal outlets, and the Potable Water Tank vents will require inspection and approval by the USPHS/FDA, and issuance of Certificates of Sanitary Construction (CSC) to WSF. It is paramount that the Contractor employ craft persons with prior understanding of the applicable health rules and regulations, and prior installation experience in such installations, to facilitate an installation that meets the design, rules, and regulations for such installations.

See Section 73 of the Technical Specification for general pump and pump material requirements.

See Section 74 of the Technical Specification for general piping and material requirements.

See Section 75 of the Technical Specification for insulation and lagging requirements.

All systems and associated equipment shall comply with the requirements of Section 74 of the Technical Specification, Reference (11C), and 46 CFR §56.

As a design **ALTERNATIVE** to the plumbing drain and potable water systems, as set forth in the Technical Specification, WSF would entertain an arrangement during the Phase II Technical Proposal stage of this Contact which provides for one (1) Sewage Holding Tank and one (1) Potable Water Storage Tank on each End of the Vessel as follows:

SEWAGE SYSTEM

- Of the two (2) tanks at each End, as set forth in the Technical Specification, one tank on each End would be provided as a Sewage Holding Tank and the other tank would be provided as a Potable Water Storage Tank. The arrangement of the tanks would be that the sewage holding tank on one End of the Vessel will be on the opposite side of the Vessel as the sewage holding tank on the other End of the

Vessel. A cross connect pipe, appropriately sized for the service, shall be provided between the two (2) sewage holding tanks.

- Each Sewage Holding Tank shall be serviced by a single appropriately sized aeration blower system utilizing a single aeration blower serving each tank. See Section 70 of the Technical Specification.
- Each Sewage Holding Tank shall be serviced by a single appropriately sized power exhaust system utilizing a single exhaust fan serving each tank. See the *Vent Pipes* Subsection in this Section of the Technical Specification.
- Each Sewage Holding Tank shall be serviced by a single appropriately sized sewage transfer pump system utilizing a single transfer pump serving each tank. Each transfer pump shall be capable of servicing the holding tanks at both Ends of the Vessel. See Section 70 of the Technical Specification.
- Each of the two (2) Sewage Holding Tanks shall be serviced by a single Model Design sized cleaning and back-flushing system utilizing a single tank and appropriately sized pump which serves both sewage holding tanks and shore discharge stations. The cleaning and back-flushing system shall be capable of servicing the holding tanks and discharge stations at both Ends of the Vessel. See Section 59 of the Technical Specification.
- Provide a deep sink station in Tank Room No. 2 with a lift station, and drain matching the sink station provided Tank Room No. 1. See Sections 11, 20, and 59 of the Technical Specification.
- All requirements of the alternative systems, except as noted herein, shall remain in force as set forth in the Technical Specification. This alternative system design shall provide all system capabilities and amenities for drainage, collection, monitoring, cleaning, aeration, back-flushing, transfer, and discharge as set forth in the specified system.

POTABLE WATER SYSTEM

- Layout of the two (2) tanks at each end shall be as set forth above for the alternative SEWAGE SYSTEM. A cross connect pipe, appropriately sized for the service, shall be provided between the two (2) Potable Water Storage Tanks.
- Provide potable water supply to a Tank Room No. 2 deep sink installation spoke to above. See Section 59 of the Technical Specification.
- All requirements of the alternative systems, except as noted herein, shall remain in force as set forth in the Technical Specification. This alternative system design shall provide all system capabilities and amenities for fill, distribution, monitoring, cleaning, and transfer as set forth in the specified system.

11.4 SCUPPERS AND DRAINS

11.4.1 General

Sufficient deck drains of adequate size shall be provided and located to prevent having standing water on the decks under ordinary conditions of list and trim.

Deck drain strainers shall be fitted with removable bronze or stainless steel strainer plates having a free area of at least twice (2X) the area of the drain pipe and positively secured and flush with the finished deck.

Unless specifically required differently in the Technical Specification Sections, all drain pipes throughout the Vessel, except from plumbing fixtures, shall be adequately sized for proper system drainage, and in no case shall be less than two (2) inch NPS (three (3) inch NPS for Weather Deck drains, Passenger Deck and above, increasing to four (4) inch NPS below Passenger Deck).

Drain piping shall be routed as directly as possible and shall be provided with accessible clean-out connections, for clearing the drain pipes by use of a plumber's "snake". Clean-out connections shall be provided with extensions so that the plug or cap is outside the insulation line to allow for access. Clean-out connections shall be the same size as the nominal pipe size of the drain line up to two (2) inches. For piping drains larger than two (2) inches, a two (2) inch clean out shall be provided. There shall be a clean-out connection at least every fifty (50) feet.

Deck and fixture drain lines shall be arranged so as to provide positive drainage when the Vessel is under design conditions of list and trim, or the rolling and pitching of the vessel. Gravity drains shall have maximum possible slope, but not less than 1/2 inch per foot transversely and 1/4 inch per foot longitudinally.

In general, where drains are combined with other drains, "Y" branches or sweep tees shall be used to facilitate flow. Where drain lines are joined with other drain lines into common headers, the headers shall be increased in size for the expected flow capacity. Standard 90 degree "T" fittings or short radius "L" fittings **will not** be permitted in the plumbing drain lines.

Drain pipes from plumbing fixtures or deck drains combined with other drains located at higher elevation may be joined; however, where such connections are made, they shall be at least four (4) feet below the lowest drain to prevent back-flooding under design conditions of list and trim, and under the rolling and pitching of the Vessel.

11.4.2 Interior Deck Drains

Interior deck drains shall be installed and fitted with strainer plates as set forth in the *SCUPPERS AND DRAINS - General* Subsection above.

1 Interior deck drains with integral or inverted bell (baffle and trap) type traps **will not** be
2 acceptable.

3 Provide a minimum of six (6) deck drains serving each of the Men's and Women's Public
4 Restrooms. Provide four (4) of the drains, generally installed in the four (4) corners of
5 each restroom space, and two (2) of the deck drains, generally down the center (fore and
6 aft) of each restroom. These deck drains shall provide satisfactory drainage during all list
7 and trim conditions. These six (6) drains are in addition to the single deck drain serving
8 each Cleaning Gear Locker in each restroom.

9 Provide a minimum of two (2) deck drains in each Unisex Restroom. These deck drains
10 shall be installed near the inboard/outboard bulkheads to provide satisfactory drainage
11 during list conditions.

12 Provide a minimum of two (2) deck drains in the Engineer's Restroom. These deck
13 drains shall be installed near the inboard/outboard bulkheads to provide satisfactory
14 drainage during list conditions.

15 **11.4.3 Sanitary Drains**

16 Drains shall be provided for all water closets, urinals, service sinks, lavatories, showers,
17 drinking fountains, interior deck drains, laundry equipment, refrigeration coil condensate
18 drain systems, and other plumbing fixtures throughout the Vessel. The sanitary drainage
19 system shall be a gravity system. A vacuum type sanitary drainage system **will not** be
20 acceptable.

21 All plumbing drains, soil drains (drains from water closets and urinals) and interior deck
22 drains shall lead to the Sewage Holding Tanks for eventual transfer ashore. Soil drains
23 shall be routed to the Sewage Holding Tanks independent from all other drains.

24 No drainage line of any kind, nor any pipe carrying wash water, salt water, or other non-
25 potable liquid, shall pass through any Potable Water Tank.

26 Sanitary drains shall be kept separate from the weather deck drains.

27 To assist in long term prevention of clogging and maintenance problems, the valves in
28 the cross-connect piping between the two (2) Sewage Holding Tanks shall be provided as
29 full-port ball valves.

30 A Sewage Lift Station shall be provided for the sanitary, gray water, interior deck, and
31 elevator pit drains from the Engineer's Restroom, Day Room, and Engineer's Stores
32 service sink. A second lift station shall be provided for the Tank Room No. 1. The lift
33 station shall transfer accumulated sewage to the Sewage Holding Tanks automatically via
34 level switches and non-clogging type sewage transfer pump(s). The vent from the lift
35 station shall be located in the weather and arranged so as to avoid contaminating the

Vehicle Decks, other accessible weather decks, and the intake of ventilation systems with noxious fumes.

A second lift station shall be provided in Tank Room No. 1 to support the service sink (see Section 20 of the Technical Specification) in that space and shall transfer accumulated gray water to the Sewage Holding Tanks as set forth in the previous paragraph. Operation and piping system, except for the vent, shall be the same as the above Sewage Lift Station installation. The vent from the lift station shall be routed to the overhead of the Tank Room.

All drains shall have traps with accessible clean-out connections, except in the overhead of the Small Galley and Cafeteria Area. Drain traps shall be deep enough to prevent backflow from the pitching and rolling of the Vessel.

Individual and combined drains shall be vented. Vents may be fitted with anti-siphonic valve terminals where unavoidable, and when approved by the WSF Representative on a "case-by-case" basis, in lieu of running vent piping. Anti-siphonic vent valve terminals shall be located above ceiling levels.

The size of all service sink, laundry, and drinking fountain drains shall be at least 1½ inch NPS.

Interior deck drains shall be provided in all fan rooms, commissary spaces, refrigerated spaces, toilets, showers, toilet and shower rooms, air plenums, laundry spaces, entrance areas from the weather, Emergency Generator Room, Passenger elevator pits, machinery space platforms and similar spaces where water may collect. Deck drains in all spaces indicated, including fan rooms, shall provide drainage in all areas under design conditions of list and trim. Drains from fan rooms, plenum chambers and other spaces with openings to the weather, which are not located in close proximity to weather or plumbing drain lines, may spill on the exterior deck via check valves.

Central air conditioning units and cooling coils in fan rooms shall be provided with drains. Each of these drains shall be directly connected to plumbing drains and be fitted with a self-sealing trap, or shall discharge into an open funnel to a fan room deck drain. These drains shall be lagged to prevent condensation.

Interior deck drains that combine with sanitary drains shall be fitted with air gaps and funnels as well as traps.

11.4.4 Weather Deck Drains

The housetop weather deck drains shall be at least three (3) inches NPS and spaced as necessary to prevent standing water on the weather decks, but in no case more than twenty-seven (27) feet apart. The scupper drain piping on each lower deck shall be increased by ½ inch NPS over that of the deck above, with a four (4) inch NPS maximum. Drains from decks above shall be led via waterbars or gutterways adjacent to scuppers where possible. Sun Deck and above drains shall be routed down the house side, terminating above a ¼ inch thick (10.2#) steel doubler plate approximately three (3) inches above the deck below. Passenger Deck drains shall be routed inboard of the curtain plate and discharge directly overboard not more than nine (9) inches above the Main Deck level onto a ¼ inch thick steel doubler plate on the top horizontal face of the rub rail.

The Passenger Deck walk-off grating/drain pan drains shall be three (3) inch NPS and tie into the above mentioned Passenger Deck drains routed down the inboard side of the curtain plate.

The total capacity of the weather decks drainage system shall be sufficient to drain all decks, without progressive accumulation of water, at a rainfall rate of up to one (1) inch per hour.

BE ADVISED: Areas that after installation, “pond” water in excess of ½ inch deep over an area in excess of (in any direction) one-half the distance or greater to the next installed weather drain shall require fairing by flame straightening or mechanical displacement to facilitate draining and pooling of less than ¼ inch deep in the distance size criteria herein at the Shipyard’s sole expense and schedule. The use of filler products to fair these decks **shall not** be permitted.

Access for clean-out of weather deck drains shall be provided, as needed. In addition to the bend radius requirements of Section 74 of the Technical Specification, 90 degree bends in weather deck piping shall be avoided (45 degree bends are preferable). Bends shall be used in lieu of fittings wherever possible.

11.4.5 Vehicle Space Drains

All watertight hatches installed in the Lower Vehicle Deck shall be provided with 1½ inch drain piping systems. Drain piping shall be provided with clean-outs and routed out through the shell. All installations shall meet the requirements of the USCG.

11.5 BILGE PIPING SYSTEM

A bilge system shall be provide that is capable of pumping from and draining any watertight compartment below the Lower Vehicle Deck (LVD), except for fuel, oil and water tanks which have a means of filling and emptying independent of the bilge system. The bilge pumping system shall be sized and configured in accordance with the Authoritative Agency requirements.

Each bilge pump shall be a GOULD, Model 3796 MT, or equal, self-priming centrifugal type, with one (1) pump located in each Reduction Gear Room. The bilge system shall be segregated by Vessel End, with the bilge suction/discharge valves manifolded and arranged for easy access. Suction manifolds serving each End of the Vessel shall be cross connected to allow the pump on one (1) End of the Vessel to dewater compartments in the other End.

The bilge system shall be capable of operation under all practicable conditions after a casualty, whether the Vessel is upright or listed. Arrangements shall be made whereby water in a compartment will drain to the suction pipe(s) for that compartment. Efficient means shall be provided to drain water from tank tops and other watertight flats. Provision shall be made to prevent the compartment served by any bilge suction piping from being flooded in the event the pipe is severed or otherwise damaged by collision or grounding in any other compartment.

All suction pipes shall be provided with a galvanized steel five (5) sided, split rose box to allow for installation and removal from the suction pipe. Total area of the rose box perforations shall be not less than six (6) times the suction pipe area. All fasteners shall be Type 316 stainless steel with nyloc type nuts.

Each bilge pump shall have a suitably sized duplex suction strainer. Strainers shall be identical with bronze body, quick opening yoke lids and Monel baskets. Provide two (2) spare Monel baskets. Provide stainless steel drip trays under both strainers. Installation shall include differential pressure gages at each strainer.

In addition to the required overboard discharges, the bilge pumps shall be capable of discharging to the oily water holding tank. The Oily Water Holding Tank shall be pumped out to shore via the Used Oil and Oily Water Transfer Pump as described in Section 70 of the Technical Specification.

A bilge-stripping pump, of the air operated diaphragm type, polypropylene center block, Buna-N internal (wetted) parts, long-life Ultra-Flex diaphragms, aluminum housing, WILDEN P-8 Pro-Flo, or equal, shall be hose and kamlock connection piped in a parallel arrangement with one (1) of the main bilge pumps. Compressed air for the stripping pump shall be supplied from the compressed air system described in Section 72 of the Technical Specification.

11.6 OILY WATER SEPARATOR SYSTEM

Provide supply, suction, recirculation, and discharge piping to/from the oil water separator in Engine Room No. 1 as set forth in the *OILY WATER SEPARATOR SYSTEM* Subsection in Section 70 of the Technical Specification.

11.7 SOUNDING TUBES, VENTS AND OVERFLOWS

Design and provide vents, sounding tubes and overflows. Material specifications for the vents, sounding tubes and overflow piping are provided in Section 74 of the Technical Specification. Specific compliance with 46 CFR §56.50-85, §56.50-90, and §56.50-95 is also required.

11.7.1 Sounding Tubes

Unless otherwise noted, sounding tubes of not less than 1½ inch Schedule 80 pipe shall be provided for all Steering Gear Rooms, Voids, cofferdams and tanks, except the Potable Water Tanks and Sewage Holding Tanks. Each sounding tube shall be located to end approximately two (2) inches above the lowest point in the tank or void, and rise vertically straight to its upper terminus. Curvature or slope in sounding tubes shall be avoided wherever possible. A curvature of less than a twenty (20) feet minimum radius shall be permitted in sounding tubes only with WSF Representative prior approval, and **where unavoidable only**. Reverse bends **will not** be permitted.

Sounding tubes shall terminate at a location that is accessible at all times under normal service conditions and, if possible, shall terminate in the machinery spaces.

Each sounding tube leading to the Lower Vehicle Deck shall terminate near the machinery casing island clear of vehicles in a bronze deck plate with a flush deck box, DESANNO No. 7, or equal. The deck plates shall be engraved with the identification of the tank or space. Each sounding tube from a hull or fuel tank terminating in the machinery space shall have a self-closing gate valve, located thirty (30) inches above the floor plates, and labeled to identify the tank or space. Sounding tubes for independent tanks may terminate at tank top with a threaded coupling and plug arrangement. See Section 24 of the Technical Specification for engraving/labeling requirements.

Provide corrosion resistant 36 inch high × 18 inch “T” wrenches and mounting brackets to fit deck box plugs. Mount the “T” wrenches on the inboard bulkheads of the machinery casing, one (1) near each sounding tube. With a permanently installed label plate, clearly mark the wrenches as to their use.

Two (2) standard sounding tapes shall be provided, one for the oil tanks and one for the other tanks. The sounding tapes shall be turned over to the WSF Representative at delivery of the Vessel.

Unless otherwise noted, a $\frac{1}{2}$ inch thick (20.4#) steel striking plate shall be welded to the tank below each sounding tube. As an alternative to the hull-attached $\frac{1}{2}$ inch plate, a $2\frac{1}{2}$ inch \times $2\frac{1}{2}$ inch \times $\frac{3}{8}$ inch steel angle may be attached to the end of the sounding tube with a $\frac{3}{16}$ inch minimum double fillet weld to serve as the striking plate. Sounding tubes shall be installed so the top of the striker plate is not more than two (2) inches above the tank bottom.

11.7.2 Vent Pipes

Design and provide all system tanks with vents. For the potable fresh water and sanitary flushing water tanks, the vent will serve as the overflow. Vents shall be Schedule 40 steel pipe, or as required by Authoritative Agencies and those leading from the potable fresh water, sanitary flushing water and sewage holding tanks shall be hot-dipped galvanized. If there is a conflict between the material requirements of this Technical Specification and Authoritative Agencies, the more stringent shall prevail.

All tanks and compartments fitted with filling, flooding, pumping, and drainage through which pressure pipe runs, shall be vented. All void spaces except the vehicle ramp voids shall be mechanically ventilated as described in Section 12 of the Technical Specification. Flanged take-down connections shall be provided in vent lines for fitting of blanks to allow tank air testing.

As far as possible, tank vents shall be located in the highest part of the tank. Special care shall be taken to provide air escape passages and holes in way of any structure that prevents proper venting to the pipe. Vent piping runs shall slope to prevent accumulation of moisture in the piping. The minimum pitch of vent piping shall be $\frac{1}{4}$ inch per foot in the transverse direction and $\frac{1}{8}$ inch per foot in the longitudinal direction.

Each Potable Water Tank vent shall terminate above the Lower Vehicle Deck, through a TATE ANDALE 52-90F In-The-Line Vertical Vent Check Valve without flame barrier shield, or equal, and then discharge out through the Curtain Plate in order to prevent contamination from other fluids. The Potable Water Tank vents shall also serve as the tank overflows.

A powered vent system shall be installed for each Sewage Holding Tank. The vent systems shall be of adequate capacity to keep the sewage tanks from going aerobic. For each Sewage Holding Tank, the vent shall be six (6) inch pipe, and shall be routed to a Radial exhaust fan in the Fidley. Provide an FRP Radial Fume Exhauster, NEW YORK BLOWER Model RFE 200, 400 CFM, 4-inches of water gage, 1.0 BHP, 3500 RPM, or equal, for the exhaust fan. The fan shall discharge through the funnel. The fan speed and power shall be verified to ensure the sewage tank remains under a slight negative pressure under all conditions, including when the sewage transfer system is used to transfer sewage into the tank. A valved crossover line shall be provided between the two

1 (2) powered sewage vent lines to allow each blower to serve either Sewage Holding
2 Tank.

3 The internal cross-sectional area of each vent/overflow pipe shall not be less than 125-
4 percent ($\geq 125\%$) of the internal cross-sectional area of the fill line. When necessary, the
5 size of vent pipes shall be increased to compensate for long runs, bends, combined
6 branches, and other features affecting the flow resistance in the pipes.

7 **11.7.3 Vent Terminals**

8 Vent terminals above the weather deck shall terminate in the atmosphere at least thirty
9 (30) inches above the deck and with approved gooseneck fittings. The number of vent
10 terminals above the weather deck shall be kept to a minimum consistent with good
11 shipbuilding practice. Vent terminal heights and locations shall be arranged to avoid
12 introducing any unnecessary down-flooding points on the Vessel.

13 Vent terminals for lubricating oil, hydraulic oil, oily water holding, and used oil tanks
14 shall vent into the space where the tank is located. No vent, fill, or discharge connection
15 from any hazardous system shall be located within thirty-six (36) inches of any opening
16 into any ventilation system intakes or discharges. Location of tank vent terminals near
17 ventilation terminals shall be avoided. Fill and discharge lines for the diesel oil,
18 lubricating oil, hydraulic oil, oily water holding tank, and used oil tanks shall terminate in
19 a recessed Lower Vehicle Deck fueling/containment station.

20 The Vent terminal for the Diesel Oil Overflow Tank shall terminate in the same Diesel
21 Oil fill station on the Lower Vehicle Deck as the above paragraph. Vent Terminals for
22 all other fuel oil tanks and the Stern Tube vents shall terminate in a thirty (30) inch high
23 goose neck fittings located just inboard of the Curtain Plate on the Upper Vehicle Deck.

24 Vent terminal screens shall be well protected against mechanical damage and arranged so
25 as to prevent painting of the mesh. The clear area through the mesh shall not be less than
26 150-percent ($\geq 150\%$) of the internal cross-sectional area of the vent pipe for screens
27 having $\frac{1}{32}$ inch square openings and less. The clear area through other screens shall not
28 be less than the internal cross-sectional area of the vent pipe. Screens shall be of
29 stainless steel or bronze.

30 Automatic ball float valves shall, in general, be fitted to all vent pipes from spaces below
31 the Lower Vehicle Deck unless otherwise approved. Flame screens shall be fitted only
32 where necessary.

33 **11.7.4 Overflows**

34 The vent/overflow piping system requirements for the diesel oil storage tanks, day tank
35 and overflow tank are discussed in Section 56 of the Technical Specification also.

11.8 OPERATING GEAR

Remote operating gear shall be provided for valves in locations inaccessible for local operation and as required herein. Handwheels or deck plates for operating gear shall be located where readily accessible and shall in no case be in locked spaces. See Section 74 of the Technical Specification for additional remote operator requirements.

As far as practical, operating gear shall be kept near bulkheads, and brackets shall be attached to bulkheads rather than to decks. Provision shall be made to allow for small movement of the decks and bulkheads without throwing the gear out of alignment or causing binding.

Collision bulkhead valve remote operator deck boxes shall be located near each Steering Gear Room access hatch to locate them away from truck paths and into the Vehicle Deck passenger walkway.

The design and arrangement of the operating gear shall be such as to reduce friction to a minimum and require minimum power for operation.

Valve operating gear shall have sufficient mechanical advantage to ensure that the valve can be unseated and opened from the distant point of operation by an average person, demonstrated by test after installation. Where valves have distant operating gear, provision shall be made to ensure the practicability of operation at the valves themselves in case the control gear becomes jammed.

Where universal joints are used, the angle between shaft lines shall not exceed thirty (30) degrees.

11.9 SEA CHESTS

The number of sea chests shall be minimized; however, at least one (1) sea chest shall be provided in each Engine Room. Each sea chest shall have only one (1) sea suction valve. Sea valves shall be angle type when located on top of a sea chest.

Each sea chest shall be fabricated of no thinner than $\frac{3}{4}$ inch (30.6#) steel plate and fitted with a slotted steel strainer plate or close-mesh steel bar grating. Strainer plate slots shall have an aggregate clear area equal to at least three (3) times the internal free area of the sea chest valve. Strainer plates shall be fastened to mounting plates at each sea chest using **monel** fasteners and cotter pins. Strainer plates, when installed, shall be flush with the surrounding plating. Zinc anodes shall be fitted in the sea chests as described in Section 14 of the Technical Specification.

The sea chests shall each have one (1) 2 inch NPS or larger vent line. Each vent shall terminate near a deck drain and be fitted with a sea valve located at the sea chest.

The sea chests shall be fitted with zincs as described in Section 14 of the Technical Specification.

Each sea chest strainer plate shall be fitted with an access panel to facilitate underwater diver inspections of sea chests and related piping inlets. Each panel shall be hinged on one side, bolted on the others and centered beneath the sea chest suction piping inlet. The panels shall provide a 12 inch × 12 inch clear opening. Hinges shall be monel and installed inside of the sea chests. The inspection ports shall be attached with monel fasteners.

11.10 OVERBOARD DISCHARGES

Overboard discharges shall be located above the growth margin deep load waterline. Each overboard discharge hull penetration shall be designed and installed in accordance with ASTM F994 Type II, Class 1 or Type III, Class 2 and the regulatory requirements. Each penetration shall include a standard 150# flange (ANSI B16.5). On four (4) inch IPS pipe size and larger, four (4) plate brackets shall be welded between the back side of the flange and the doubler plate, equally spaced between bolt holes. The bracket thickness shall be $\frac{3}{8}$ inch up to six (6) inch pipe, then will change to $\frac{1}{2}$ inch thick for pipe six (6) inches and above. A flanged, cast steel or nodular iron stop valve shall be bolted directly to the shell fitting. Where necessary, operating rods shall be fitted to permit operation of the valves from the Engine Room deck plates. Readily accessible valves shall have rising stems, or indicators, and valves with reach rods shall have indicators to show the valve position. Piping from the overboard discharges shall have elbows or bends between the outboard discharge and the first rigid connection inboard.

11.11 SPARE PARTS AND INSTRUCTION MANUALS

Provide a list of recommended spare parts and special tools for those items that are Contractor furnished, together with any parts lists and instruction manuals necessary, to maintain and service provided equipment and accessories in accordance with the requirements of Sections 86 and 100 of the Technical Specification.

11.12 TESTING AND INSPECTIONS

Tests shall be in accordance with this Section and Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and in Sections 1 and 101 of the Technical Specification.

11.13 PHASE II TECHNICAL PROPOSAL REQUIREMENTS

The following deliverables, in addition to other deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase II Technical Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

- A. Piping System Calculations - Sanitary Drainage Piping System
- B. Piping System Calculations - Weather Deck Drains Piping System
- C. Piping System Calculations - Bilge Piping System
- D. Sea Chest Sizing Calculations

11.14 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS

The following deliverables, in addition to other deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase III Detail Design and Construction stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

- A. Piping System Calculations - Sanitary Drainage Piping System
- B. Piping System Calculations - Weather Deck Drains Piping System
- C. Piping System Calculations - Bilge Piping System
- D. Powered Sewage Vent System Fan and Duct Sizing Calculations
- E. Sea Chest Sizing Calculations

(END OF SECTION)